

**Amendments to the Claims:**

This listing of claims will replace all prior versions and listings of claims in the application.

**Listing of Claims:**

1. (Original) An objective lens for an optical disk comprising a single lens having aspheric surfaces on both sides and focusing light beams into a point image through first and second optical disk substrates each having a different thickness,

at least one of the aspheric surfaces comprising two regions including an inner circumference region at an inner side of a circular aperture having an optical axis as a center and an outer circumference region located at an outer side with respect to the inner circumference region, the aspheric profile of the outer circumference region correcting a spherical aberration with respect to the first optical disk substrate which has a smaller thickness than the second optical disk substrate, and the aspheric profile of the inner circumference region correcting a spherical aberration with respect to the second optical disk substrate, the outer circumference region and the inner circumference region are in contact with each other at the boundary therebetween with a difference in level in the direction of the optical axis,

wherein the objective lens satisfies the following relationships (1) to (4);

$$t_1 < t_2 \quad (1)$$

$$0.05 < T W < 0.12 \quad (2)$$

$$0.38 < N A 1 < 0.46 \quad (3)$$

$$0.1 < p (n - 1) / \lambda < 0.6 \quad (4)$$

wherein  $t_1$  denotes a thickness of the first optical disk substrate,  $t_2$  denotes a thickness of the second optical disk substrate,  $NA1$  denotes a NA of the objective lens at the aperture of the inner circumference region,  $TW$  denotes a wavefront aberration when light beams are focused through the first optical disk substrate (unit is  $\lambda$ : rms),  $n$  denotes a refractive index of the objective lens at the wavelength of a light source when data of the first optical disk is reproduced,  $p$  denotes a difference in level between the inner circumference region and the outer circumference region in

the direction of the optical axis; and  $\lambda$  denotes a wavelength of the light source when data of the first optical disk is reproduced.

2. (Original) The objective lens for an optical disk according to claim 1, wherein the third order spherical aberration component  $S_3$  of the wavefront aberration is approximately 0 when light beams are focused through the first optical disk substrate.

3. (Original) The objective lens for an optical disk according to claim 1, wherein a fifth order spherical aberration component  $S_5$  (unit is  $\lambda$ :rms) of the wavefront aberration satisfies the following relationship (5) when light beams are focused through the first optical disk substrate.

$$-0.03 < S_5 < 0.03 \quad (5)$$

4. (Original) The objective lens for an optical disk according to claim 1, wherein the thickness  $t_3$  of the optical disk substrate satisfies the following relationship (6), when the aspheric profile of the inner circumference region is optimized so that the spherical aberration is corrected with respect to the thickness  $t_3$  of the optical disk substrate.

$$0.8 < t_3 < 1.2 \quad (6)$$

5. (Original) The objective lens for an optical disk according to claim 1, wherein the cross section of the portion having the difference in level between the inner circumference region and the outer circumference region has a circular arc profile.

6. (Original) The objective lens for an optical disk according to claim 1, which is formed by glass molding or plastic molding.

7. (Original) An objective lens for an optical disk comprising a single lens having aspheric surfaces on both sides and focusing light beams into a point image through first and second optical disk substrates each having a different thickness,

at least one of the aspheric surfaces comprising three regions including of an inner circumference region at an inner side of a circular aperture having an optical axis as a center, a middle region located at an outer side with respect to the inner circumference region and surrounded by another circular aperture that is located at an outer side of the circular aperture, and an outer circumference region located at an outer side with respect to the middle region, the aspheric profiles of the inner circumference region and the outer circumference region correcting a spherical aberration with respect to the first optical disk substrate which has a smaller thickness among the first and second optical disk substrates, and the aspheric profile of the middle region correcting a spherical aberration with respect to an optical disk substrate having a thickness that is larger than any of the first and second optical disk substrates, wherein the objective lens satisfies the following relationships (7) and (8);

$$0.35 < NA_2 < 0.43 \quad (7)$$

$$0.03 < NA_3 - NA_2 < 0.1 \quad (8)$$

wherein  $NA_2$  denotes a NA of the objective lens at the boundary between the inner circumference region and the middle region, and  $NA_3$  denotes a NA of the objective lens at the boundary between the middle region and the outer circumference region.

8. (Original) The objective lens for an optical disk according to claim 7, wherein the thickness  $t_4$  of the optical disk substrate satisfies the following relationship (9), when the aspheric profile of the middle region is optimized so that the spherical aberration is corrected with respect to the thickness  $t_4$  of the optical disk substrate.

$$1.4 < t_4 < 2.0 \quad (9)$$

9. (Original) The objective lens for an optical disk according to claim 7, wherein either the boundary in which the inner circumference region is connected to the middle region or the boundary in which the middle region is connected to the outer circumference region does not have a difference in level.

10. (Original) The objective lens for an optical disk according to claim 7, wherein the cross section of the portion having a difference in level between the inner circumference region and the middle region or the cross section of the portion having a difference in level between the middle region and the outer circumference region has a circular arc profile.

11. (Original) The objective lens for an optical disk according to claim 7, which is formed by glass molding or plastic molding.

12. (Original) An objective lens for an optical disk comprising a single lens having aspheric surface on both sides and focusing light beams into a point image through first and second optical disk substrates each having a different thickness,

at least one of the aspheric surfaces comprising three regions including of an inner circumference region at an inner side of a circular aperture having an optical axis as a center, a middle region located at an outer side with respect to the inner circumference region and surrounded by another circular aperture that is located at an outer side of the circular aperture, and an outer circumference region located at an outer side with respect to the middle region, the aspheric profiles of the inner circumference region and the outer circumference region correcting a spherical aberration with respect to the first optical disk substrate which has a smaller thickness than the second optical disk substrate, a thickness  $t_5$  of the optical disk substrate satisfies the following relationship (10) when the aspheric profile of the middle region is optimized so that the spherical aberration is corrected with respect to the thickness  $t_5$  of the optical substrate, and the outer circumference region is formed with a difference in level corresponding to an integral

multiple of the optical path length in the direction of an axis with respect to the inner circumference region,

wherein the objective lens satisfies the following relationships (11) to (13)

$$1.0 < t_5 < 1.4 \quad (10)$$

$$t_1 < t_2 \quad (11)$$

$$0.35 < NA_2 < 0.43 \quad (12)$$

$$0.03 < NA_3 - NA_2 < 0.1 \quad (13)$$

wherein  $t_1$  denotes a thickness of the first optical disk substrate,  $t_2$  denotes a thickness of the second optical disk substrate,  $NA_2$  denotes a NA of the objective lens at the boundary between the inner circumference region and the middle region, and  $NA_3$  denotes a NA of the objective lens at the boundary between the middle region and the outer circumference region.

13. (Original) The objective lens for an optical disk according to claim 12, wherein the focal position in which a wavefront aberration of the inner circumference region is minimized and the focal position in which a wavefront aberration of the outer circumference region is minimized are the same when light beams are focused through the second optical disk substrate.

14. (Original) The objective lens for an optical disk according to claim 12, wherein the third order spherical aberration component  $S_3$  of the wavefront aberration in the ranges of the inner circumference region and the middle region is approximately 0 when light beams are focused through the second optical disk.

15. (Original) The objective lens for an optical disk according to claim 12, wherein the boundary in which the inner circumference region is connected to the middle region does not have a difference in level.

16. (Original) The objective lens for an optical disk according to claim 12, wherein the boundary between the middle region and the outer circumference region is provided at the intersection point of the profiles of the middle region and the outer circumference region.

17. (Original) The objective lens for an optical disk according to claim 12, wherein both the boundary in which the inner circumference region is connected to the middle region and the boundary in which the middle region is connected to the outer circumference region do not have a difference in level.

18. (Original) The objective lens for an optical disk according to claim 12, which is formed by glass molding or plastic molding.

19. (Currently Amended) An optical head device comprising two light sources, a focusing means for focusing light beams emitted from the two light sources onto an information medium surface through first and second optical disk substrates each having a thickness corresponding to the respective light sources, a light flux separating means for separating light fluxes modulated at the information medium, and a light receiving means for receiving the light means modulated at the information medium, wherein the focusing means is the objective lens for an optical disk according to claim 1, 7, or 12.

20. (Original) An optical information recording and reproducing apparatus recording information on the information medium surfaces of first and second optical disk substrates each having a different thickness, or reproducing information recorded on the information medium surfaces by the use of an optical head device, wherein the optical head device according to claim 19 is used as the optical head device.

21. (Canceled)

22. (Canceled)

23. (Canceled)

24. (Canceled)

25. (Currently Amended) An objective lens for an optical disk comprising a single lens made of glass and focusing light beams into a point image through first and second optical disk substrates each having a different thickness,

at least one surface of the objective lens being divided into a least three regions by concentric circles having an optical axis as a center, the three regions including a first region including the optical axis and a second region located outermost part are rotationally symmetric aspheric surfaces, and a third region sandwiched by the first region and the second region is a toric surface having the optical axis as an axis of rotation ~~The objective lens for an optical disk according to claim 21,~~ wherein the third region is a toric surface obtained by rotating a circular arc with an optical axis as a center, the circular arc having a radius R satisfying the following relationship (14)[[.]]

$$0.7 \text{ mm} < R < 2.5 \text{ mm} \quad (14)_1$$

26. (Currently Amended) An objective lens for an optical disk comprising a single lens made of glass and focusing light beams into a point image through first and second optical disk substrates each having a different thickness,

at least one surface of the objective lens being divided into a least three regions by concentric circles having an optical axis as a center, the three regions including a first region including the optical axis and a second region located outermost part are rotationally symmetric aspheric surfaces, and a third region sandwiched by the first region and the second region is a toric surface having the optical axis as an axis of rotation ~~The objective lens for an optical disk according to claim 21, wherein the third region is a toric surface obtained by rotating a circular arc with an optical axis as a center, the circular arc having a radius R satisfying the following relationship (15)[[.]]~~

$$1.6 \text{ mm} < R < 2.1 \text{ mm} \quad (15)_1$$

27. (Currently Amended) An objective lens for an optical disk comprising a single lens made of glass and focusing light beams into a point image through first and second optical disk substrates each having a different thickness,

at least one surface of the objective lens being divided into a least three regions by concentric circles having an optical axis as a center, the three regions including a first region including the optical axis and a second region located outermost part are rotationally symmetric aspheric surfaces, and a third region sandwiched by the first region and the second region is a toric surface having the optical axis as an axis of rotation ~~The objective lens for an optical disk according to claim 21, wherein the width w of the third region satisfies the following relationship (16)[[:]]~~

$$0.02 \text{ mm} < w < 0.04 \text{ mm} \quad (16)_1$$



28. (Canceled)

29. (Previously presented) A mold for molding a lens produced by grinding cemented carbide, a lens molding surface being divided into at least three regions by concentric circles having an optical axis as a center, among the three regions, a first region including the optical axis and a second region located outermost part are rotationally symmetric aspheric surfaces, the third region sandwiched by the first region and the second region is a toric surface having the optical axis as an axis of rotation, wherein a radius of curvature  $R$  of the toric surface having the optical axis as an axis of rotation satisfies the following relationship:  $0.7 \text{ mm} < R < 2.5 \text{ mm}$ .

30. (Canceled)

31. (Original) The mold for molding a lens according to claim 29, wherein the radius of curvature  $R$  of the toric surface having the optical axis as an axis of rotation satisfies the following relationship (18).

$$1.6 \text{ mm} < R < 2.1 \text{ mm} \quad (18)$$

32. (Previously presented) A method for working a mold for molding a lens, comprising: grinding a lens molding surface divided into at least three regions by concentric circles having an optical axis as a center, among the three regions, a first region including the optical axis and a second region located outermost part being rotationally symmetric aspheric surfaces, the third region sandwiched by the first region and the second region being a toric surface having the optical axis as an axis of rotation by the use of a diamond grindstone, wherein a radius of the diamond grindstone used for the grinding work is the same as or smaller than a radius of curvature of the toric surface, wherein the radius  $R$  of the diamond grindstone satisfies the following relationship:  $0.7 \text{ mm} < R < 2.5 \text{ mm}$ .

33. (Canceled)

34. (Original) The method for working a mold for molding a lens according to claim 32, wherein the radius R of the diamond grindstone satisfies the following relationship (20):

$$1.6 \text{ mm} < R < 2.1 \text{ mm} \quad (20)$$

35. (Canceled)